

PROPHET MATHS PLUGIN

Powerful mathematical functions

Summary

Modern solvency and accounting regulations often require complex calculations to fully assess embedded risks. The Prophet Maths Plugin is a collection of mathematical functions provided for use within Prophet Professional and Prophet Enterprise.

The plugin provides high level **matrix operations** that include:

- Eigen decomposition which is the factorization of a matrix into a canonical form, whereby the matrix is represented in terms of its eigenvalues and eigenvectors.
- Nearest Correlation Matrix (NCM) which is a symmetric matrix with unit diagonal and nonnegative eigenvalues.

In addition, the plugin has **statistical distribution** functions that include **copulas** and efficient random **sampling** routines. **Curve fitting** and function **solver** are also fully supported.

The functions enable effective and appropriate models to be easily built to reflect the true underlying risks of many insurance products within asset, investment, life or general/P&C insurance.

Maths Plugin key features:

Focused design – created by FIS' experts for efficient performance

Integration – simply adds into standard Prophet library code as additional function calls

Completeness – covers matrix operations, statistical distributions, copulas, sampling, curve fitting, sorting and solver routines

Wide usage – helps to efficiently and effectively meet the challenging needs of modern solvency and accounting standards

Powerful and simple – standard functions to enable fully aggregated stochastic model distributions

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- **Array sorting**
- **Curve fitting**
- **Function solver**
- **Statistical distributions**
 - Alpha stable distribution with type 0 parameterisation
 - Beta distribution
 - Binomial distribution
 - Cauchy Lorentz distribution
 - Chi Squared distribution
 - Scaled inverse Chi Squared distribution
 - Exponential distribution
 - Fisher distribution
 - Frechet distribution
 - Gamma distribution
 - Inverse Gamma distribution
 - Geometric distribution
 - Gumbel distribution
 - Hyper Geometric distribution
 - Inverse Gaussian distribution
 - laplace distribution
 - Levy distribution
 - Logistic distribution
 - LogNormal distribution
 - LogSeries distribution
 - n dimensional Archimedean copula
 - n dimensional Gaussian copula
 - Independent n dimensional copula
 - n dimensional Student T copula
 - Negative Binomial distribution
 - Normal distribution
 - Pareto distribution
 - Poisson distribution
 - Rayleigh distribution
 - Students t distribution
 - Triangular distribution
 - Continuous Uniform distribution
 - Discrete Uniform distribution
 - Weibull distribution
- **Statistical measures**
 - Hazard Function
 - Kurtosis of distribution
 - Highest available moment
 - Mean of distribution
 - Median of distribution
 - Mode of distribution
 - Skew of distribution
 - Standard deviation of distribution
 - Smallest closed set whose complement has probability zero
 - Variance of distribution
- **Mathematical functions**
 - Beta function.
 - Normalised Beta Inverse function.
 - Binomial Coefficient N choose k
 - Logarithmic derivative of Gamma function
 - Factorial - Single and Double
 - Factorial Ratio
 - Gamma function.
 - Normalised Gamma Inverse function.
 - Ratio of Gamma a over Gamma b
 - Gauss error function
 - Gauss error function inverse
 - Greatest Common Divisor
 - Lowest Common Multiple
 - Log of Gamma
 - Owens T function for bivariate normal distribution
 - Zeta function
- **Matrix functions**
 - Make Correlation Matrix From Covariance Matrix
 - EigenValue Only Matrix Decomposition
 - Eigenvector Matrix Decomposition
 - Hessenberg Matrix Decomposition
 - Cholesky LDLT Matrix Decomposition With Pivoting
 - Cholesky LLT Matrix Decomposition
 - LU Matrix Decomposition With Row Pivoting
 - LU Matrix Decomposition With Row And Column Pivoting
 - QR Matrix Decomposition
 - QR Matrix Decomposition With Column Pivoting
 - Schur Matrix Decomposition
 - Singular Value Only Matrix Decomposition
 - Singular Value Matrix Decomposition
 - Tri-diagonal Matrix Decomposition
 - Find Nearest SPD Symmetric Matrix With Unit Diagonals
 - Norm of Matrix
 - Matrix Linear Solver: $Ax = b$
 - Make Matrix Symmetrical using $(A + AT)/2$
 - Transpose Matrix
- **Sampling**
 - A random uniform 32bit signed integer
 - N samples from a multivariate distribution
 - A sample from a multivariate distribution
 - N samples from a univariate distribution
 - A random sample from a univariate distribution
 - Seed the random number generator
 - Random uniform real number on $[0,1)$

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About FIS' Prophet

FIS' Prophet is a leading enterprise-wide actuarial modeling system that helps insurance and financial services companies meet reporting responsibilities, improve risk management, and develop more profitable products faster. Prophet uses customizable actuarial libraries for all major product types, including regional variations. It provides the transparency, performance and control required by today's actuaries and risk managers through integrated financial modeling and data management capabilities. Prophet is used by more than 10,000 users at nearly 1000 customer sites in over 70 countries.

About FIS

FIS is a global leader in financial services technology, with a focus on retail and institutional banking, payments, asset and wealth management, risk and compliance, consulting and outsourcing solutions. Through the depth and breadth of our solutions portfolio, global capabilities and domain expertise, FIS serves more than 20,000 clients in over 130 countries. Headquartered in Jacksonville, Florida, FIS employs more than 53,000 people worldwide and holds leadership positions in payment processing, financial software and banking solutions. Providing software, services and outsourcing of the technology that empowers the financial world, FIS is a Fortune 500 company and is a member of Standard & Poor's 500® Index. For more information about FIS, visit www.fisglobal.com